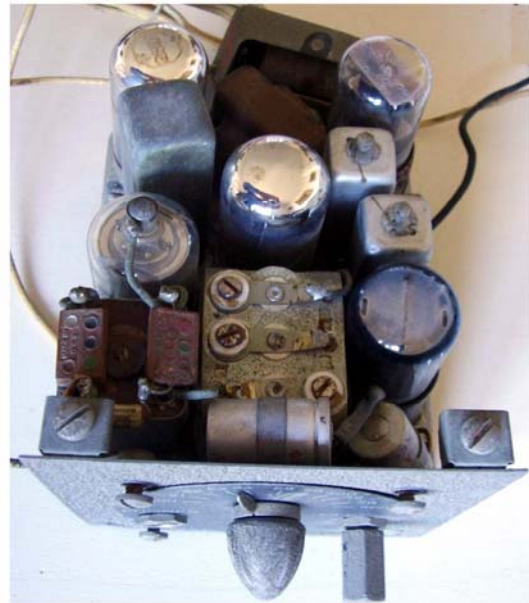


## Detrola 43B - Low-Frequency Radio Range Receiver



- Click to enlarge.

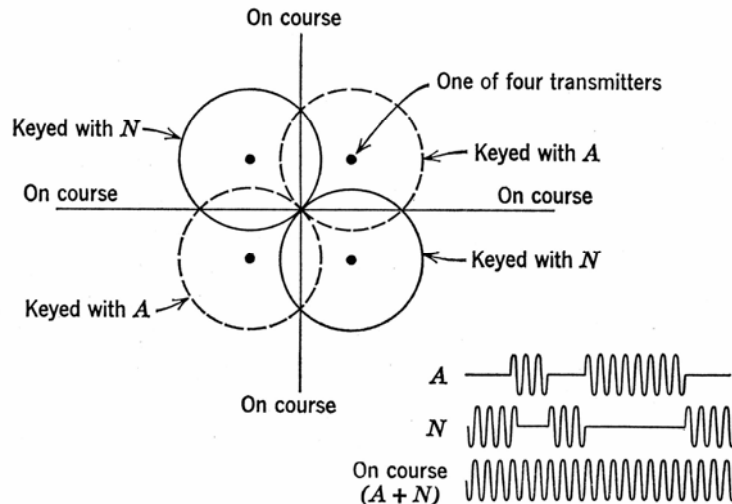
This is a very compact radio receiver to be used in small boats or aircraft as navigation aid to the low-frequency radio range standard. The receiver, made by Detrola, appears to be a 5-tube superheterodyne operating over a tuning range from 200 to 400 kHz. Overall dimensions in millimeters are 107 wide by 107 high by 180 deep. Commands on the front panel are just the volume control associated with the power supply switch and the tuning control knob with coaxial gear reduction driving the tuning pointer. A phone jack is on the left side. The label below warns as follows:

### ‘NOTICE

Not to be removed by ferry pilot or others  
except upon instruction of unit commander’

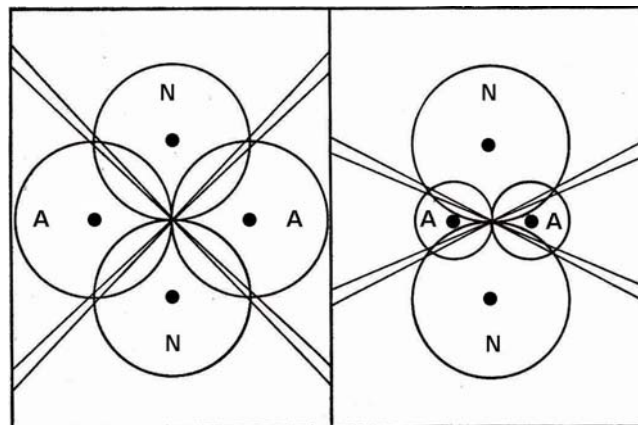
The receiver works with 26.5 volts supply even for anodic voltage. Not needing a high-voltage vibrator-type power supply, this solution makes it possible to save space and increase the reliability. Tubes are: 6K7GT RF amplifier, 6SA7GT converter, 6SK7GT/G IF amplifier, 6SQ7GT/G detector and AF amplifier, 28D7 power audio amplifier.

The low-frequency radio range, also known as A-N radio range or four-course radio range, was one of the very early navigation systems. It was in use since 1929 and up to the sixties for marking both air and marine courses and guide aircraft or boats respectively to their airport or to the harbor. The system was based upon the emission of complementary Morse signals from an antenna system based upon two perpendicular Adcock antenna pairs. Four radiation lobes were generated, their intersections giving the wanted courses.



- Generalized antenna system used in the LF radio range. Actually two transmitters, one keyed with A letter the second one keyed with N, fed two Adcock antenna systems. Adcock antenna system was derived from the rectangular loop type, widely used for its directivity in radio goniometry, suppressing the horizontal segments which gave no contribution to the directionality.

Depending upon the relative amplitude of the signals, angles of each course with respect to the others could be varied as in the two examples below.



- Polar diagrams for systems of two Adcock pair radiating antennas fed with different signals. Left, four perpendicular routes of continuous note are generated when both Adcock pairs are fed with signals of equal amplitude. Right, angles between routes can be modified feeding the two Adcock pairs with signals of different amplitude.

One Adcock pair was fed with a tone-modulated signal giving the 'A' Morse character, dot-dash, the second one emits the complementary 'N' character, dash-dot. When the pilot was straight in one of the four ranges, he could hear a continuous tone. Depending upon the course and the direction, if he moved to one side, he received the 'N' stream. On the contrary he could hear an 'A' stream when he moved to the opposite side. A fifth antenna in the middle of the array could be added to rotate the relative directions of the four ranges, by feeding with the proper amplitude and phase relations each of the other four ones. The fifth antenna tower was also used to transmit voice messages.

Frequencies assigned to the LR radio range system were in the long wave region of the spectrum. In America 65 channels spaced 3 kHz apart between 200 and 400 kHz were assigned to this service.

In some sets a visual indicator, based upon the vibration of two resonant reeds, gave information about the side and the magnitude of deviation from the route.

The LF radio range system was effective up to about 200 nautical miles, giving typical site error of 1° and instrument or sensitivity error of the same magnitude. Unfortunately propagation errors up to 25° could be observed beyond the horizon, due to sky-wave propagation and to interferences by remote stations. The system performance was also quite poor during thunderstorms.

Probably the LF radio range was the most used navigation system during WWII. In US about 100,000 LFR airborne receivers were still in active service in 1968.

- **Source of information on the LF radio range system: 'Avionic Navigation Systems' by Myron Kayton and Walter R. Fried, 1969.**
- **Source of information on Adcock antenna systems: War Department Technical Manual TM 11-476, 'Radio Direction Finding', July 1947**